Hydrothermal Zoning in the Copper-Molybdenum System Beneath Red Cone Peak, Colorado

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Hypothesis:

The Red Cone igneous complex (RCC) displays characteristics of a large porphyry copper system (see Fig 1). This research addresses a fundamental question: was there an early copper event in the Colorado Mineral Belt that has gone unrecognized, and which may be related genetically to the well known molybdenum event that to date has characterized the Mineral Belt? The RCC intruded from 42 to 38 million years ago, which was 5 to 10 million years before the world-class molybdenum deposits at Climax (25 km to the southwest) and Henderson (20 km to the northeast). The timing of emplacement of the RCC and the characteristics of the mineralization could make it unique from the surrounding deposits. The results of this study will provide a better understanding of the Red Cone system and a more complete picture of mineralization in this part of Colorado.

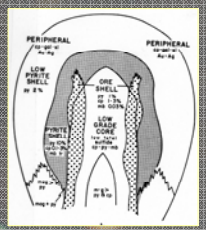


Fig 1. Lateral and vertical zoning in porphyry ore deposits. From Sillitoe, 1973.

Setting:

Red Cone Peak lies one mile south of the Continental Divide, and about 50 miles southwest of Denver, Colorado. The Red Cone igneous complex is within the Colorado Mineral Belt, a zone of igneous bodies and associated hydrothermal mineralization that crosses the mountainous part of the state from southwest to northeast. Materials used in this study were collected from Webster Pass, 0.6 mile WNW of Red Cone Peak (see figures).

Top Elev. 12,096ft.

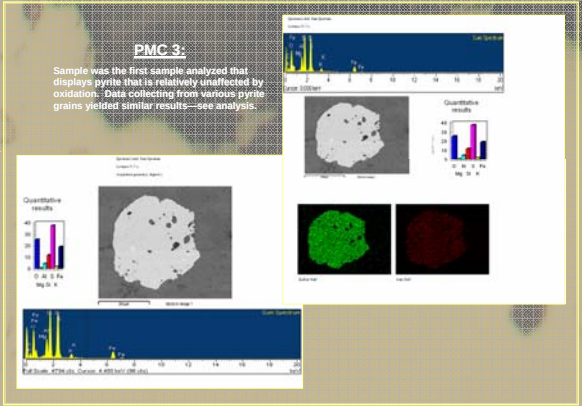
Current Data:

PMC 2:

Sample contains only hematite (Fe_2O_3), which was produced by the complete oxidation of pyrite (FeS) during weathering. This slide was not analyzed further.

PMC 3:

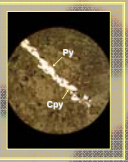
Sample was the first sample analyzed that displays pyrite that is relatively unaffected by oxidation. Data collecting from various pyrite grains yielded similar results—see analysis.



PMC 4:

PMC 5:

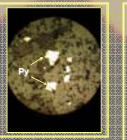
First sample taken from the igneous region of the core, and it displays large subhedral feldspars. Possible magnetite (Fe_3O_4) occurrences, pyrite veinlets, and disseminated pyrite crystals also are present. Veinlets contain chalcopyrite ($CuFeS_2$) crystals -- see right. Chemical analysis yet to be done.



PMC 6

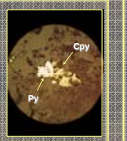
PMC 7:

Contains some sphalerite (ZnS), euhedral pyrite, and minor chalcopyrite. Pyrite veinlet is younger than disseminated minerals. Chemical analysis yet to be done.



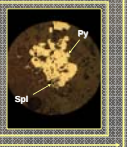
PMC 8:

Pyrite is intergrown with chalcopyrite. Specimen also contains abundant molybdenitite (MoS_2). Chemical analysis yet to be done.



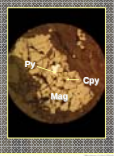
PMC 9:

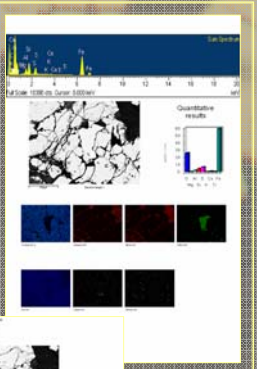
This portion of the core contains sphalerite, and veinlet and disseminated pyrite, but no visible chalcopyrite. Specimen also cut by 0.9cm vein of pyrite. Chemical analysis yet to be done.

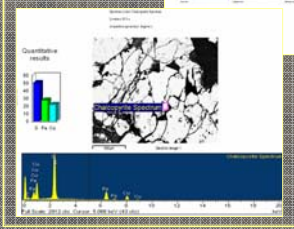


PMC 10:

Sample is the last polished surface taken from the core at a depth of 1964ft. Contains veins and disseminated magnetite. Magnetite vein contains disseminated pyrite, and veinlets and disseminated chalcopyrite. Analysis show element distributions.







Bottom Elev. 10,096ft.

Methods:

Nine samples were collected from a 2000 ft. core that was drilled on the Continental Divide at Webster Pass. Microscopic and microchemical analysis are being used to characterize the lateral and vertical zoning of hydrothermal mineralization within the Red Cone complex. Polished thin sections have been made from samples collected at regular intervals down the core. Copper and other trace elements (including molybdenum and gold) were analyzed for using multi-element SEM and quantitative X-ray microanalysis. Analyses focused on pyrite (Fe-S) and chalcopyrite (Cu-Fe-S) grains.

Drill rig on Webster Pass

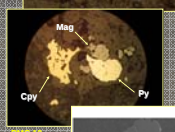
Core

Polished Surfaces

SEM

Sample Depth	
Slide	Depth
PMC 2	88 ft.
PMC 3	440 ft.
PMC 4	777 ft.
PMC 5	969 ft.
PMC 6	1160 ft.
PMC 7	1377 ft.
PMC 8	1719 ft.
PMC 9	1903 ft.
PMC 10	1964 ft.

PMC 8



PMC 10

PMC 9 SEM Image

Current Progress:

A general mineral zoning exists megascopically within the core -- pyrite giving way to pyrite + chalcopyrite with depth. I have not (yet) found micro-chemical zoning within the pyrite with depth, an original goal of the research, but we now believe may be in the pyrite shell of a porphyry copper system, and that the zoning could be found closer to the center of the complex or at greater depths, or both. Three more cores have been drilled to date, and none of these has been studied in the detail applied to the Webster Pass core. Work continues and future studies will benefit considerably from the microscopic and analytical work that is being done on the present core.